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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/839,963	04/23/2001	Sangki Hong	CS99-210	4495

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EXAMINER

MALDONADO, JULIO J

ART UNIT

PAPER NUMBER

2823

DATE MAILED: 02/27/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/839,963

Applicant(s)

HONG ET AL.

Examiner

Julio J. Maldonado

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 07 January 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-3,5-12 and 14-23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-3,5-12 and 14-23 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

1. Applicant's cancellation to claims 4 and 13 is acknowledged.
2. The non-final rejection as set forth in paper No.4 is withdrawn in response to applicants' request for reconsideration.
3. A new 103(a) rejection is made as set forth in this Office Action.
4. Claims 1-3, 5-12 and 14-23 are pending in the application.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al. ('568) in view of Wang et al. (U.S. 6,080,660).

In reference to claims 1-3, 5, 7-10, 14-19, 22 and 23, Liu et al. (Figs.1-9) in a related method to form self-aligned anti-via interconnects teach the steps of providing a semiconductor substrate comprising semiconductor devices (2, 3, 4) in and on a silicon substrate (1) covered by an insulating layer (5); depositing a first metal layer (7) overlying said semiconductor substrate, wherein said metal layer (7) comprises aluminum; depositing an etch-stop layer (8) overlying said metal layer (7), wherein said etch-stop layer (8) comprises titanium nitride; depositing a second metal layer (9) overlying said first metal layer (7), wherein said metal layer (9) comprises aluminum; etching through said second metal

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layer (9), said etch stop layer (8), and said first metal layer (7) to form connective lines (10, 11, 12); etching through said second metal layer (9) to form vias (40), wherein said etch stop layer (8) acts as an etch stop; depositing a dielectric layer (30) overlying said vias (40), said connective lines (10, 11, 12) and said semiconductor substrate; and polishing down said dielectric layer (30) to complete said self-aligned, anti-via interconnects in the manufacture of the integrated circuit device, wherein said semiconductor substrate comprises semiconductor devices (2, 3, 4, 6) in and on a silicon substrate covered by an insulating layer (5) (column 6, line 54 – column 7, line 64).

Liu et al. fail to teach the steps of depositing an antireflective coating (ARC) layer comprising titanium nitride over the second metal layer; performing a timed etching process; and using silicon oxide as a dielectric layer. However, Wang et al. (Figs.2A-2C) in a related method to form interconnect structures teach the steps of depositing an antireflective coating (ARC) layer (24) comprising titanium nitride over a metal layer (22); performing a timed etching process; and using silicon oxide as a dielectric layer (23) (column 3, line 55 – column 4, line 26). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to use titanium nitride as an ARC layer and silicon oxide as a dielectric layer as taught by Wang et al. in the anti-via formation method of Liu et al., since these materials are commonly used in the fabrication of metal interconnects (column 1, lines 34-63). It would also have been obvious in the art at the time of the invention was made to perform a timed etch on the metal layer as taught by Wang et al. in the anti-via formation method

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of Liu et al., since timed etching process are used to control the degree of etching (column 4, lines 22-26).

In reference to claims 6, 11, 12, 20 and 21, Liu et al. in combination with Wang et al. substantially teach all aspects of the invention but fail to show depositing a dielectric layer to a thickness of between about 5,000 angstroms and 20,000 angstroms and depositing a metal layer to a thickness of between about 3,000 angstroms and 10,000 angstroms. However, the selection of the claimed range is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. In re Jones, 162 USPQ 224 (CCPA 1955)(the selection of optimum ranges within prior art general conditions is obvious) and In re Boesch, 205 USPQ 215 (CCPA 1980)(discovery of optimum value of result effective variable in a known process is obvious).

Response to Arguments

7. Applicant's arguments filed 01/7/2003 have been fully considered but they are not persuasive.

Applicants' argue that Wang et al. "...is not analogous to the timed etch performed by the applicants where no dielectric layer is formed over the conductive layer...prior to the timed etch..." and "...the timed etch of Wang creates a slanted topography...". In response to this argument applicants assert that Wang et al. do not teach the forming a dielectric layer prior to the timed etch and that the invention of Wang et al. create a slanted topography. However, Wang et al. was relied on controlling the etching by a timed etch and this process

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can be performed either on a dielectric layer as disclosed by Wang et al. or on a conductive layer as disclosed in the claimed invention. Wang et al. wasn't relied on performing a timed etch prior to deposit a dielectric layer or creating a slanted topography as argued. The added teachings do not render invalid the teachings relied on.

Also, applicants' argue, the titanium/titanium nitride layer of Wang et al. "...is not obvious to one skilled in the art..." since "...the sides of the conductive layer are not exposed by the dielectric layer...the titanium/titanium nitride layer taught by Wang et al. is not analogous with the teachings of the applicant ". in response to this argument, Wang et al. teach forming a conductive layer (22) and adding a titanium/titanium nitride layer or a titanium nitride layer (24), "which acts as a anti-reflective coating (ARC) (column 3, line 65 – column 4, line 4). This ARC layer is used for the patterning process performed on the metal layer (22) to form the metal pattern as shown in Figs.2A-2C. Therefore, Wang et al. does teach using layer 24 as an anti-reflective coating.

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory


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action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

9. Papers related to this application may be submitted directly to Art Unit 2823 by facsimile transmission. Papers should be faxed to Art Unit 2823 via the Art Unit 2823 Fax Center located in Crystal Plaza 4, room 3C23. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2823 Fax Center number is **(703) 305-3432**. The Art Unit 2823 Fax Center is to be used only for papers related to Art Unit 2823 applications.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Julio J. Maldonado** at **(703) 306-0098** and between the hours of 8:00 AM to 4:00 PM (Eastern Standard Time) Monday through Friday or by e-mail via julio.maldonado@uspto.gov. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri, can be reached on (703) 306-2794.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at **(703) 308-0956**.


JMR
2/21/03


George Fourson
Primary Examiner
2823